ELEMENTS OF AN INTEGRAGED SYSTEM FOR MONITORING BOREAL FOREST FIRES FROM SPACE

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ABSTRACT

A GIS-based method has been developed for mapping weather-dependent fire danger index under the Mission to Planet Earth Program. This method uses information provided by AVHRR and TOVS instruments installed in NOAA satellites. The radiometric NOAA fire danger index has a close correlation with Nesterov's index (0.87), as well as with Canadian BUI (0.76) and FWI (0.72). This enables forest fire danger mapping without extending the weather station network and encourages the idea to develop an integrated forest fire danger rating system, which will cover the whole boreal forest zone in the northern hemisphere.

We developed a high-resolution method that allows identification of forest fires in NOAA imagery. The method considers the capabilities of AVHRR instrument and provides data on fire energy, current atmospheric conditions, and vegetation cover. Channel 3 (3.6-3.9 micron wavelength) allows easy identification of big forest fires. Identifying small fires (3 to 25 ha) requires analysis of brightness differences in AVHRR Channels 2, 3, and 5. The method makes fire control much more effective for it enables early fire detection. The method needs a higher thermal saturation (about 1100K) in reference to the 3.7 micron AVHRR Channel 3 for active fire detection.

We determine a combination of day and night time satellite survey that is optimal for detecting fires and removing false alarms. Most common false alarm sources are cirrus and overheated areas that are identified during simultaneous processing of information coming from channels of visible and IR bands. Algorithms and programs are now available to cut off false alarms.

In order to quickly evaluate fire fighting resource needs and predict fire effects, we suggest that fires should be classified by both area and total energy. We developed a program and an algorithm to estimate fire radiation without respect to probable spotting. We propose to continue to design an international satellite for detecting forest fire starts, estimating smoke cover, and evaluating post fire forest state. The satellite should work in a sun-synchronous orbit and have eight bands, 250 m spatial resolution, and 2,000 km viewing swath.

Contributions of carbon emissions from fires in Canada, Eastern Siberia and the Russian Far East into global carbon budget show high severity of forest fires in the northern parts of Canada and Russia and emphasize the need for their permanent monitoring.